

K-12 Achievement Standards Teacher's Guide

to

Math



Idaho Standards for Achievement

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E-mail: cmiller@osbe.state.id.us

Ms. Rita Foltman
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E-mail: rfoltman@osbe.state.id.us

Idaho State Board of Education
PO Box 83720
Boise, ID 83720-0037
(208) 332-1590
Fax: 334-2632
1-877- 394-8464
www.idahoboardofed.org/saa.asp

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TABLE OF CONTENTS - MATH

255.	MATHEMATICS STANDARDS.....	4
256.	MATHEMATICS STANDARDS – GRADE KINDERGARTEN, SECTIONS 257 THROUGH 263.	4
266.	MATHEMATICS STANDARDS – GRADE 1, SECTIONS 267 THROUGH 273.....	7
276.	MATHEMATICS STANDARDS – GRADE 2, SECTIONS 277 THROUGH 283.....	11
286.	MATHEMATICS STANDARDS – GRADE 3, SECTIONS 287 THROUGH 293.....	16
296.	MATHEMATICS STANDARDS – GRADE 4, SECTIONS 297 THROUGH 303.....	22
306.	MATHEMATICS STANDARDS – GRADE 5, SECTIONS 307 THROUGH 313.....	28
316.	MATHEMATICS STANDARDS – GRADE 6, SECTIONS 317 THROUGH 323.....	34
326.	MATHEMATICS STANDARDS – GRADE 7, SECTIONS 327 THROUGH 333.....	40
336.	MATHEMATICS STANDARDS – GRADE 8, SECTIONS 337 THROUGH 343.....	47
346.	MATHEMATICS STANDARDS – GRADES 9 THROUGH 12, SECTIONS 347 THROUGH 353.	54

216. GLOSSARY OF MATHEMATICAL TERMS.

01. Appropriate Technology. May include paper and pencil, graph paper, simple calculators, graphing calculators, computers with spreadsheets, or even specialized mathematics software such as Geometer's Sketchpad or Maple. It is the decision of school districts and teachers to determine which tools are most appropriate for both instruction and application.

02. Arithmetic Operations. Basic operations on numbers, including addition, subtraction, multiplication, division, and exponentiation (raising a number to a power).

03. Function. One (1) of the most important and fundamental concepts in mathematics. Functions have inputs (domain values) and transform these inputs into unique outputs (range values). The function is the process or rule that accomplishes this transformation. Functions may be described by:

- a. Tables of values, such as a table of heights with associated idealized weights.
- b. Graphs, such as a chart depicting a company's daily closing stock price over the last year.
- c. Calculator function buttons, where the domain (input) value is the number keyed in, the function is performed by the circuitry in a chip, and the range (output) value is the number read in the display after pressing the function button.
- d. Spreadsheet functions, where the domain (input) value is the content of the cell referenced, the function is the subprogram that actually performs the computation, and the range (output) value is the number that is computed.
- e. An explicit formula, such as the squaring function " $f(x)=x^2$ " which takes any input " x " and transforms it by multiplying " x " by itself.

04. The Language Of Algebra. Algebra is that branch of mathematics dealing with the study of number systems. The common number systems include the natural numbers, the integers (includes zero and the negatives of the counting numbers), the rational numbers (fractions), the real numbers (decimals), and the complex numbers (like $2 - 4i$). Algebra uses letters and other symbols to describe general properties of numbers, to specify conditions placed on them, or to describe relationships between them.

05. Linear Equation. An equation, in which the variables (unknowns) occur only to the first power, multiplied only by constants. For example, the equations:

$$4x - 3 = \sqrt{2} \quad \text{and} \quad \frac{1}{2}x - 7y = 11$$

are linear in one (1) and two (2) variables respectively, while: $x^2 + 5x + 7 = 0$ and $xy = 1$ are nonlinear equations. A linear equation in two (2) variables has a graph that is a straight line in the coordinate plane. A linear equation in three (3) variables has a graph which is a plane in 3-space.

06. Linear Programming. A mathematical technique to solve optimization problems involving linear objective functions (such as maximizing profit or minimizing cost) subject to linear inequality constraints (such as amount of ingredients available, the relative proportions used, and relative costs).

07. Linear System. A system of more than one (1) equation or inequalities, each using the same variables, and each linear. A solution to the system is any assignment of values to the variables that makes every equation or inequality simultaneously true. The complete solution is the set of all possible solutions.

08. Mathematical Model. Equations, inequalities, functions, or other mathematical expressions that model a real-world process. Realistic mathematical models are increasingly important in the modern world, especially with the increased use of powerful computers. Many processes, which formerly could only be studied by expensive laboratory experiments, can now be studied as realistic mathematical models.

09. Mean, Median, And Mode. Three (3) common ways to measure the center of a set of numerical data. The mean is the arithmetic average of the data. The median is the middle value of the sorted data set with an odd number of items or the average of the middle two (2) values when the data contains an even number of items. The mode is the most common data value, if it exists. Of the three (3), the mean and median are more useful and frequently used. In any particular application, whether the mean or median is more appropriate depends on the data set and the intended use.

10. Order Of Operations. The commonly accepted rules used for reading algebraic expressions or evaluating arithmetic expressions.

- a. Evaluate expressions inside parentheses first.
- b. Within the same level of parentheses:
 - i. Evaluate exponents first;
 - ii. Evaluate products and/or quotients next;
 - iii. Evaluate sums and/or differences last.
- c. Examples: $2 * 3^2 + 4 = 22$, $2(3^2 + 4) = 2 * 13 = 26$, $(2 * 3)^2 + 4 = 6^2 + 4 = 40$.

11. Probability.

a. The branch of mathematics dealing with chance. The experimental model is one (1) illustration of probability. Imagine an experiment with outcomes. An event is a collection of outcomes. The probability of an event is the proportion of the experiments that result in an outcome in the event. The probability of an event is always a number between zero (0) and one (1). Events with probabilities near one (1) are very likely to occur, while those with probabilities near zero (0) are very unlikely.

b. Example. To estimate the probability that a randomly selected, adult American female is between sixty (60) inches and sixty-six (66) inches tall, select an adult American female at random and measure her height. If one thousand (1,000) women are selected and measured, the probability would be the proportion of the experiments that selected a woman between those heights.

12. Pythagorean Theorem. A theorem from Euclidean geometry about right triangles. The hypotenuse of a right triangle is the side opposite the right angle. The legs are the other two (2) sides. The theorem states that the square of the hypotenuse is the sum of the squares of the legs.

13. Quadratic Equation. An equation, which can be reduced to the form $ax^2 + bx + c = 0$, with a , b , and c constants, where a does not equal 0.

14. Scaling Factor. The ratio between the corresponding dimensions of two (2) figures of the same shape.

15. Statistics. The branch of mathematics dealing with collecting, analyzing, and reasoning from data. The process may involve collecting all of the possible data (a census), or it may involve collecting a subset or sample of the data. The analysis may involve organizing, condensing, calculating summary measurements (statistics), or constructing graphical displays. These descriptive tools help draw conclusions about the real world from which the data originated. When appropriate, probability models provide the framework for attaching a measure of confidence to the conclusions.

16. Standard Deviation. A measure of the spread of a set of numerical data. If a data set has a relatively large standard deviation, then the data is very spread out. If the standard deviation is small, the data is highly clustered. (4-5-00)

17. Tolerance. The acceptable range of accuracy of a measurement, or the allowable error in a given measurement.

217. -- 254. (RESERVED).

255. MATHEMATICS STANDARDS.

The language of mathematics is a powerful tool for exploring, explaining, and understanding the universe. Proficiency in using mathematics is vital to citizens of an increasingly technological society.

When students exit high school they will be able to use mathematics to solve problems in real world situations. Students will apply mathematics across disciplines, using appropriate technology in applying and communicating their strategies and solutions. Appropriate technology may include paper and pencil, graph paper, simple calculators, graphing calculators, computers and spreadsheets, or specialized software.

A glossary of mathematical terms can be found in Section 216.

256. MATHEMATICS STANDARDS – GRADE KINDERGARTEN, SECTIONS 257 THROUGH 263.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

257. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Demonstrate knowledge of our numeration system by counting in a variety of ways.	i. Rote count from 0 to 20. ii. Rote count backwards from 10 to 0. iii. Identify ordinal numbers 1 st through 3 rd .
	b. Demonstrate an understanding of the verbal, symbolic, and physical representations of a number.	i. Put number cards in order from 0 to 10. ii. Match the value of a number with its corresponding numeral. iii. Count a set of objects using one-to-one correspondence.
	c. Identify a penny as a value of money.	i. Use pennies to purchase items from a school store.
02. Perform computations accurately.	a. Explore the concepts of addition and subtraction using concrete objects.	i. It's snack time. If you have 4 cookies and you eat 2 cookies, how many cookies will you still have? ii. Use the counting bears to show that the 3 bears are at the dinner table. 2 more bears join them. How many bears are at the table?
	b. Use appropriate vocabulary.	
03. Estimate and judge reasonableness of results.	a. Use estimation to identify a number of objects.	i. Identify the reasonableness of the number of teddy bear counters in a small jar (up to 10).

	b. Evaluate the reasonableness of an answer.	i. Estimate the number of blocks (up to 10) in a bag. Count the number of blocks to find the total, and note which estimates are reasonable.
	c. Use appropriate vocabulary.	

258. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Select strategies appropriate to solve a problem.	i. Use: <ul style="list-style-type: none"> • guess and check • act it out • draw a picture • build a model
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use concrete objects to identify and show a solution to problems.	i. Given a picture or story, use counters to make up your own number story and solution.
03. Apply appropriate technology and models to find solutions to problems.	a. Select appropriate models to represent mathematical ideas.	i. Use keys of a 4-function calculator to manipulate numbers - Clear, On and Off buttons.
04. Communicate results using appropriate terminology and methods.	a. Use appropriate vocabulary to communicate mathematical information.	i. Use vocabulary terms: <ul style="list-style-type: none"> • more • less • same • number

259. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is to understand the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Explore the use of standard and non-standard tools for measuring time, length, volume, weight, and temperature.	i. Use non-standard units (for instance, paper clips, hands, shoes) to measure items in class for length, volume, and weight. ii. Use thermometers to measure relative temperature. iii. Use digital and analog clocks to understand that it tells the time. iv. Use a calendar to determine the day of the week and the day's date.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	
	c. Use appropriate vocabulary.	

260. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Compare sets of objects using vocabulary (less than, greater than, same as).	i. Identify which set of objects is greater, less, or the same as.
	b. Explore the relationship between addition and subtraction.	i. There were 2 bears at the gym. 3 more bears came. How many bears were at the gym? 1 bear got sick and went home. How many bears were still at the gym?

261. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.	i. Teacher touches the shape and the child tells the name of the shape. ii. Teacher tells the name and the child touches the corresponding shape. iii. Go on a shape walk.
	b. Recognize and create shapes that have symmetry.	
	c. Explore slides, flips, and turns.	
	d. Understand and apply appropriate vocabulary for position and size.	i. Appropriate vocabulary: above, below, up, down, over, under, inside, outside, top, bottom, between, middle, before, after.
02. Apply graphing in two dimensions.	a. Apply ideas about direction and distance.	

262. DATA ANALYSIS, PROBABILITY, AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Interpret information from real objects and simple pictographs.	i. Provide a simple graph such as how many girls and how many boys and determine most, least, and same.
	b. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: graph, same, different, least, most, sort, predict, and tally.

02. Collect, organize, and display data.	a. Create a graph using real objects or pictorial representations.	i. Use children's shoes to build a graph to tell how the shoes fasten. Put the question "How do we fasten our shoes?" at the top of the graph. ii. Use a pictograph to show how students get to school (ride or walk).
03. Understand basic concepts of probability.	a. Predict and perform results of simple probability experiments.	i. Place 3 objects, 2 of 1 color and 1 of another color, in a bag. Predict what color will be drawn from the bag.
04. Make predictions or decisions based on data.	a. Make predictions or decisions based on probable results or past experiences.	i. If it has been snowing for 3 days, should a person wear a bathing suit outside?

263. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Replicate and extend patterns and identify the rule (function) that creates the pattern.	i. Copy and extend a pattern using unifix cubes. Use the same pattern using different colors.
	b. Sort and classify objects by attributes.	i. Sort by shape, color, size, and other attributes using attribute blocks.
	c. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: sort, pattern, and count.

264. -- 265. (RESERVED).

266. MATHEMATICS STANDARDS – GRADE 1, SECTIONS 267 THROUGH 273.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

267. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skill and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Demonstrate knowledge of our numeration system by counting in a variety of ways.	i. Start at 23 and count to 56. ii. Start at 28 and count backwards to 12. iii. Rote count by 10s, 5, and 1s to 100. iv. Skip count by 2s to 10. v. Students line up and count by ordinal numbers (1 st to 10 th).
	b. Read, write, order, and compare whole numbers to 100.	i. Order 41, 60, and 15 from least to greatest.

	c. Demonstrate the knowledge of place value through 99.	i. Say and write the number 87 as 8 tens and 7 ones. ii. Appropriate vocabulary: tens, ones.
	d. Identify and state the value of pennies, nickels, and dimes.	
02. Perform computations accurately.	a. Demonstrate proficiency of addition up to 10 and an understanding of subtraction from 9.	i. Build a number in a variety of ways: <ul style="list-style-type: none"> Show a variety of ways to build (compose) a number ($1 + 4 = 5$, $2 + 3 = 5$, $5 + 0 = 5$, $1 + 1 + 3 = 5$). Show a variety of ways to decompose a number ($6 - 5 = 1$, $6 - 2 = 4$, $6 - 0 = 6$, $6 - 3 = 3$).
	b. Use appropriate vocabulary.	
03. Estimate and judge reasonableness of results.	a. Use estimation to identify a number of objects.	i. Identify the reasonableness of the number of jellybeans in a small jar (up to 30).
	b. Use estimation to predict computation results.	i. Which is the best estimate of the sum of $10 + 9 = ?$ About 2, about 11, or about 20?
	c. Evaluate the reasonableness of an answer.	i. Given $9 - 4$, would 10 be a reasonable number?
	d. Use appropriate vocabulary.	

268. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Select strategies appropriate to solve a problem.	i. Use: <ul style="list-style-type: none"> guess and check act it out draw a picture build a model
	b. Select and use appropriate operations.	i. Determine whether to add or subtract when given a word problem.
02. Use reasoning skills to recognize problems and express them mathematically.	a. Draw a picture and generate a number sentence from a problem-solving situation.	i. Make a picture and a number sentence for the following problem: I have 5 bikes in my garage. How many wheels do I have?
03. Apply appropriate technology and models to find solutions to problems.	a. Select appropriate models to represent mathematical ideas.	i. Use the +, -, and = keys of a 4-function calculator to manipulate numbers.

04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Know +, -, =, and the vocabulary for each.
	b. Use appropriate vocabulary to communicate mathematical information.	i. Understand math is expressed in various ways: <ul style="list-style-type: none"> • add, plus, more • subtract, minus, less • equals, is the same as ii. Use sum and difference to refer to answers for addition and subtraction.

269. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is to understand the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Explore the use of standard and non-standard tools for measuring time, length, volume, weight, and temperature.	i. Use non-standard units (for instance, paper clips, hands, shoes) to measure items in class for length, area, volume, and weight. ii. Use analog and digital clocks to measure time to the nearest hour. iii. Use thermometers to measure relative temperature.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	
	c. Use a calendar to explore measurement of time.	i. Recite the days of the week in order. ii. Determine yesterday and tomorrow when given a specific day of the week using a calendar.
	d. Use appropriate vocabulary.	

270. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Represent vertical notation in horizontal form.	i. Rewrite $\begin{array}{r} 4 \\ +3 \\ \hline 7 \end{array}$ as $4 + 3 = 7$.
	b. Write a number sentence given an addition or subtraction problem.	i. Determine the correct number sentence for a story problem. (Identifying necessary vs. unnecessary information.).
	c. Compare numbers using vocabulary (less than, greater than, equal to, more, less, same, fewer, bigger, smaller).	i. Is 44 greater than or less than 30? ii. Which is less, 25 or 13? iii. Is $2 + 1$ the same as $3 + 0$?

	d. Explore the relationship between addition and subtraction and demonstrate reversal of operations.	i. Recognize fact families.
02. Evaluate algebraic expressions.	a. Explore and use the commutative property of addition.	i. $3 + 2 = 2 + 3$.

271. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.	i. Identify a circle, triangle, rectangle, and square.
	b. Recognize and create shapes that have symmetry.	i. Find objects at home or in class that are examples of the above shapes. ii. Identify lines of symmetry on simple objects (Pine tree).
	c. Explore slides, flips, and turns.	
	d. Understand appropriate vocabulary.	i. Appropriate vocabulary: above, below, up, down, over, under, inside, outside, top, bottom, between, middle, before, after. ii. Appropriate vocabulary: symmetry, circle, triangle, rectangle, and square.
02. Apply graphing in two dimensions.	a. Apply ideas about direction and distance.	

272. DATA ANALYSIS, PROBABILITY, AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Interpret information found in simple graphs to answer questions.	i. Identify more, less and same after reading graph. ii. Which is your favorite apple graph (red, green, yellow)?
	b. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: tally, graph, predict.
02. Collect, organize, and display data.	a. Gather and display data in graphs in order to answer a question.	i. Tally the number of students in the class that like red, green, or yellow apples best. Create a graph of your results. ii. Tally the number of students taking hot or cold lunch for the day.

03. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. Place 3 objects, 2 of 1 color and 1 of another color, in a bag. Predict what color will be drawn from the bag. Tally the results.
04. Make predictions or decisions based on data.	a. Make predictions or decisions based on probable results or past experiences.	i. If it has been snowing for 3 days, should a person wear a bathing suit outside?

273. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify the rule (function) that creates the pattern.	i. Use pattern blocks to create a pattern that repeats after 3 objects. (Verbalize the pattern.)
	b. Sort and classify objects by more than one attribute.	i. Sort a collection of buttons by more than 1 attribute (shape, size, color, 2 holes, 4 holes). ii. Sort the same objects again by other attributes.
	c. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: skip count, pattern, and sort.

274. -- 275. (RESERVED).

276. MATHEMATICS STANDARDS – GRADE 2, SECTIONS 277 THROUGH 283.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

277. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Demonstrate knowledge of our numeration system by counting a variety of ways.	i. Count backwards from the 28 th of the month to the 1 st of the month. ii. Line up and count by ordinal numbers from 1 st to the end of the student line. iii. Say date using ordinal numbers. iv. Count by tens from random numbers (6, 15, 26...).
	b. Read, write, order, and compare whole numbers to 1,000.	i. Order 36, 173, and 14 from at least to greatest.

	c. Demonstrate the knowledge of place value through 999.	i. Say and write numeral 265 when shown 2 hundreds, 6 tens, and 5 ones with place value materials. ii. Given 378, make a model showing hundreds, tens, and ones. iii. Given $500 + 60 + 3$ in expanded form, write the correct 3-digit number. iv. Given 642, tell how many tens, ones, and hundreds.
	d. Determine, by counting, the value of a collection of pennies, nickels, dimes, and quarters, up to \$1.00.	i. Arrange 1 penny, 2 nickels, 2 dimes, and 2 quarters from greatest value coins to least and count the value (81¢). ii. Using classroom store items, choose coins to purchase an item less than 99¢. iii. Find price tags or newspaper ads that show dollar and cent signs (25¢ and \$0.25).
	e. Explore decimals using money through hundredths.	i. Recognize 10¢ and \$0.10 are equivalent values. ii. Read \$1.25 as "one dollar and twenty-five cents."
	f. Understand and apply appropriate vocabulary.	i. Appropriate vocabulary: place value, ones, tens, hundreds, penny, nickel, dime, quarter, dollar, cent, coin, change, and fraction.
02. Perform computations accurately.	a. Demonstrate proficiency with addition and subtraction facts through 18.	i. Given 6, 7, 13, write 2 addition and 2 subtraction facts ($6 + 7 = 13$, $7 + 6 = 13$, $13 - 7 = 6$, $13 - 6 = 7$). ii. Memorize doubles ($1 + 1$, $2 + 2$, $3 + 3$, $4 + 4 \dots$) and extend to doubles plus or minus 1. iii. Count on or back from the larger number in a fact problem. iv. Memorize basic facts to 18.
	b. Add whole numbers with and without regrouping through 99.	i. Add the ages of 2 teenagers or adults. ii. Add the number of students in 2 classrooms.
	c. Add a series of one-digit addends.	i. Determine the value of $6 + 5 + 4$ by looking for a combination that equals ten ($6 + 4$) and adding 5.
	d. Explore double-digit subtraction of whole numbers with regrouping through 99.	i. Use the newspaper to determine how much colder it was last night than it is today. ii. Use concrete materials (place value blocks or unifix cubes, etc.) to demonstrate $64 - 37 = \underline{\quad}$.
	e. Use appropriate vocabulary.	

03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	i. Determine how many packs of hot dogs (10 per pack) would be needed for 26 children.
	b. Evaluate the reasonableness of an answer.	i. Use a number line to determine the closest ten for a given number (round 5 to higher 10). ii. Given subtraction problem, $38 - 6$, would 44 be a reasonable answer?
	c. Use appropriate vocabulary.	

278. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Select strategies appropriate to solve a problem.	i. Use: <ul style="list-style-type: none"> • guess and check • act it out • draw a picture • build a model
	b. Select and use appropriate operations.	i. Determine whether to add or subtract when given a word problem.
02. Use reasoning skills to recognize problems and express them mathematically.	a. Generate a number sentence from a problem-solving situation.	i. Compare 2 items from a graph and make an addition or subtraction problem. ii. Count the blue cars and red cars in the parking lot and write a number sentence ($16 - 9 = 7$ or $9 + 7 = 16$ or $16 > 9 \dots$).
03. Apply appropriate technology and models to find solutions to problems.	a. Select appropriate models to represent mathematical ideas.	i. Use the +, -, and = keys of a 4-function calculator to manipulate numbers.
04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Know +, -, =, >, and <, and the vocabulary for each.
	b. Use appropriate vocabulary to communicate mathematical information.	i. Understand math is expressed in various ways: <ul style="list-style-type: none"> • add, plus, more • subtract, minus, less • equals, is the same as ii. Use sum and difference to refer to answers for addition and subtraction.

279. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is to understand the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Explore the use of standard and non-standard tools for measuring time, length, volume, weight, and temperature.	i. Start with non-standard units, for instance, paper clips, hands, or shoes, to measure items in class. ii. Use ruler, yardstick, measuring tape, scales, cups, pints, quarts, and Fahrenheit thermometer. iii. Use meter stick, centimeters, liters, balance scale, and Celsius thermometer. iv. Work with relationships in the metric system (100 centimeters equals 1 meter).
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	i. Tell whether inches or feet would be used to measure a crayon. ii. Draw something that might weigh about one pound (book, lunch box). iii. Tell whether a centimeter or meter would be use to measure a thumb.
	c. Tell time using both digital and analog clocks to the quarter hour.	i. Use the classroom clock at various times of day to tell the time (recess, lunch, dismissal).
	d. Explore the relationship among units of time.	i. Know quarter hour as 15 minutes, half hour as 30 minutes, and hour as 60 minutes. ii. Recite the days of the week in order. iii. Recite the months of the year in order. iv. Determine yesterday and tomorrow when given a specific day of the week.
	e. Use appropriate vocabulary.	

280. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Represent vertical notation in horizontal form.	i. Rewrite 6 $\begin{array}{r} +7 \\ 6 \\ \hline 13 \end{array}$ as $6 + 7 = 13$.
	b. Write a number sentence given an addition or subtraction problem.	i. Determine the correct number sentence for a story problem.
	c. Compare numbers using vocabulary (less than, greater than, equal to) and symbols (<, >, =).	i. Given 46 and 64, state, "46 is less than 64 and 64 is greater than 46." ii. Use the number line to establish the meaning of the symbols > and <.

	d. Understand the relationship between addition and subtraction and demonstrate reversal of operations.	i. Create fact families. $2 + 3 = 5$ $3 + 2 = 5$ $5 - 3 = 2$ $5 - 2 = 3$
02. Evaluate algebraic expressions.	a. Explore and use the commutative property of addition.	i. $6 + 4 = 4 + 6$.

281. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Recognize, name, build, draw, compare, and sort two- and three-dimensional shapes.	i. Identify square, rectangle, triangle, circle, and their relationships to cube, cone, pyramid, and sphere. ii. Find objects at home or in class that are examples of the above shapes. iii. Draw a circle, triangle, rectangle, and square. iv. Given a drawing of a square and a rectangle, recognize that the square is also a rectangle.
	b. Recognize and create shapes that have symmetry.	i. Cut out a heart using a folded piece of paper; use the fold to show the line of symmetry. ii. Use pattern blocks to make a symmetrical "person" and another that is not symmetrical.
	c. Explore slides, flips, and turns.	i. Use animal crackers to show position after sliding, flipping, or rotating.
	d. Understand appropriate vocabulary.	i. Appropriate vocabulary: symmetry, circle, triangle, rectangle, square, pyramid, cube, cone, sphere, flip, turn, slide.
02. Apply graphing in two dimensions.	a. Apply ideas about direction and distance.	

282. DATA ANALYSIS, PROBABILITY, AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Interpret information found in simple tables, charts, and graphs.	i. Answer simple questions after reading a table, graph, or chart. ii. Use the key or legend on a graph to determine if the symbol means 1 or more than 1.
	b. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: tally, graph, chart, table, row, column, predict.

02. Collect, organize, and display data.	a. Gather and display data in tables, charts, and graphs in order to answer a question.	i. Tally types of drinks in lunches and create a chart or graph.
03. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. Use 6 coins to record heads or tails. After 9 trials, predict the tenth outcome.
04. Make predictions or decisions based on data.	a. Make predictions or decisions based on probable results or past experiences.	i. Use a graph showing pets that belong to children in class to predict the pets of the children in an adjoining class.

283. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify the rule (function) that creates the pattern.	i. Skip count using 2s, 5s, and 10s. ii. Use tiles to display odd and even numbers.
	b. Sort and classify objects by more than one attribute.	i. Sort a collection of leaves by color, shape, and/or size. ii. Arrange pattern blocks in order of the number of sides and by color.
	c. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: odd, even, skip count, pattern.

284. -- 285. (RESERVED).

286. MATHEMATICS STANDARDS – GRADE 3, SECTIONS 287 THROUGH 293.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

287. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Read, write, order, and compare whole numbers to 10,000.	i. When given a set of whole numbers, order them from least to greatest and greatest to least.
	b. Demonstrate the knowledge of place value through 9,999.	i. Identify each place value up to the thousands place. ii. Identify the value of a given digit in a number; for instance, 9,630: 6 = 600. iii. From a newspaper or magazine, find examples of 4 in the hundreds place. iv. Use expanded notation ($9000 + 600 + 30 + 0$).

	c.	Determine, by counting, the value of a collection of bills and coins up to \$10.00.	i.	Count and write the value of a collection of coins and bills.
	d.	Use concrete materials to recognize and represent commonly used fractions.	i.	When given a set of fraction materials, select and identify parts of the whole.
			ii.	Fold a paper to show $\frac{1}{2}$ and $\frac{1}{4}$.
	e.	Explore decimals using money through hundredths.	i.	Add the cost of school supplies using dollar sign and decimal point.
			ii.	Given an amount of money with a cent sign, change to dollar sign and decimal point format (56¢ to \$0.56).
	f.	Understand and apply appropriate vocabulary.	i.	Begin to use terms: numerator, denominator, ones, tens, hundreds, thousands, decimal point, place value, greatest and least, expanded notation.
02. Perform computations accurately.	a.	Add and subtract whole numbers with and without regrouping through 999.	i.	Know basic facts through 18.
			ii.	Subtract your age from the principal's age.
	b.	Instantly recall basic addition and subtraction facts through 18.	i.	Play Bingo.
	c.	Add three addends with 1 and 2 digits.	i.	Add the lunch count from 3 classrooms.
			ii.	Change the format from horizontal to vertical.
	d.	Multiply whole numbers through 10×10 .	i.	Use concrete materials to model multiplication facts.
			ii.	Determine how many days are in 5 weeks.
	e.	Explore the relationship between multiplication and division.	i.	$3 \times 6 = 18$, $18 \div 6 = 3$.
			ii.	Work with dimes, nickels, and pennies, to explore multiples of tens, fives, and ones.
			iii.	Explore multiplication work with arrays, looking for 3 groups 2 or 3 groups of 5.
	f.	Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.	i.	Choose the best method: <ul style="list-style-type: none"> • If someone has a dollar, is there enough money to buy a candy bar and soda? • Find the total number of students in 1st, 2nd, and 3rd grade. • Given that 43 out of 100 students ride the bus, determine how many do not.
	g.	Use appropriate vocabulary.	i.	Appropriate vocabulary: addends, difference, operation, number sentence, subtraction, minus, equals, addition, sum, zero, fact family.

03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	i. Round to the nearest ten and/or to the nearest hundred: • 52 to 50; 65 to 70; 450 to 500; 108 to 100. ii. Estimate the number of half-gallon containers of milk needed for a class of 20 if each student receives 1 cup. iii. Estimate the number of cars needed for a class field trip if each car holds 6 people (not including the driver).
	b. Evaluate the reasonableness of an answer.	i. Is the reasonable height of a 3 rd grader 4 inches, 4 feet, or 4 yards?
	c. Use appropriate vocabulary.	i. Appropriate vocabulary: round and estimate.

288. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Select strategies appropriate to solve a problem.	i. Strategies: • logical reasoning • making chart or table • act it out • draw a picture • guess and check • working backwards
	b. Select and use appropriate operations.	i. Given a variety of story problems, select and use the appropriate operation.
	c. Make predictions and decisions based on information.	i. Predict the next two days' temperatures based on information from the previous two days.
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.	i. Graph favorite ice cream flavors of students. Write results in a mathematical equation such as # of students choosing chocolate is greater than # of students choosing strawberry written as: $c > s$; # students choosing chocolate plus # students choosing strawberry equals 20 students is written as: $c + s = 20$.
03. Apply appropriate technology and models to find solutions to problems.	a. Appropriately use a 4-function calculator to solve complex grade-level problems.	i. Check computation.
	b. Select appropriate models to represent mathematical ideas.	

04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Convert a story problem to a number sentence using appropriate notations, terms, and labels. ii. Classroom presentation of mathematical information obtained from research such as a chart – compare and contrast the average temperatures or rainfall in the desert and forest.
	b. Use appropriate vocabulary to communicate mathematical information.	

289. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is to understand the measurable attributes of objects.

Standards - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Select and use appropriate units and tools to make formal measurements in both systems (time, length, temperature, perimeter).	i. Introduce clocks (digital, analog), rulers, yardsticks (standard and metric), scales, thermometers (F/C), containers. What tool would you use to measure a carpet? ii.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	i. Use a reasonable measure to determine: • distance from school to home • capacity of containers of various sizes (pool versus bath tub).
	c. Explore relationships within the U.S. customary system.	i. Use a reasonable measure to determine: • distance from school to home • capacity of containers of various size (pool versus bathtub)
	d. Explore relationships within the metric system.	i. Use a reasonable measure to determine: • distance from school to home • capacity of containers of various size (pool versus bathtub)
	e. Tell time using both digital and analog clocks, using 5-minute intervals.	i. The student will make a chart listing the time of certain events during the day to the nearest 5 minutes. ii. During the school day the student will write the time on a piece of paper to the correct 5-minute interval.

	f. Explore the relationship among units of time.	i. Elapsed time: <ul style="list-style-type: none"> If you went on vacation for 3 weeks, how many days would you be gone? If a movie is 2 hours long, how many minutes would that be? ii. 24 hours in a day. iii. 7 days a week. iv. 12 months in a year. v. 52 weeks in a year. vi. 365 days in a year.
	g. Use appropriate vocabulary.	i. Appropriate vocabulary: hour, half-hour, quarter hour, minute, second, hour hand, minute hand, year, month, week, inch, foot, yard, cups, measure, meter, centimeter, liter.

290. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Represent vertical notation in horizontal form.	i. $21 + 38 = 59$ ii. $\begin{array}{r} 21 \\ + 38 \\ \hline 59 \end{array}$
	b. Write a number sentence using symbols (boxes or letters) to represent an unknown number.	i. $42 - \square = 12$ ii. $x + 7 = 10$
	c. Use symbols (<, >, =) to express relationships.	i. Use the correct symbol to make the number sentence true. <ul style="list-style-type: none"> $\square = 52$ $\square = 71$ $\square = 14$
	d. Explore inverse (reversal) of operations with multiplication and division.	i. $3 \times 6 = 18$, so $18 \div 6 = 3$.
02. Evaluate algebraic expressions.	a. Explore and use the commutative properties of addition and multiplication.	i. $a + b = b + a$. $a \times b = b \times a$.
03. Solve algebraic equations and inequalities.	a. Solve missing addends and missing factor problems using inverse operations.	

291. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.	i. Draw a circle, triangle, rectangle, and square. Identify and label sphere, pyramid, cube, cone, cylinder, rectangular prism, and list the similarities.
	b. Explore congruence, similarity, and symmetry.	i. Find examples in the classroom and on the playground of objects that are congruent, similar, and symmetrical. ii. Use letters of the alphabet and paper folding to demonstrate congruence, similarity and symmetry.
	c. Investigate perimeters in real-world situations.	i. Find the perimeter of three objects in your classroom. ii. Given a triangle puzzle piece (or a rectangle puzzle piece) add the lengths of the sides to find the perimeter.
	d. Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.	i. Slide, flip, and turn a pentomino.
	e. Use appropriate vocabulary.	i. Appropriate vocabulary: rectangle, circle, square, triangle, sphere, cube, cone, cylinder, rectangular prism, pyramid, perimeter, area.
02. Apply graphing in two dimensions.	a. Apply ideas about direction and distance.	i. Kick ball, foot ball.

292. DATA ANALYSIS, PROBABILITY, AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Interpret information found in tables, charts, and graphs.	i. Given a table of monthly temperatures, determine the highest and lowest temperature in a desert. ii. Create a legend or key to explain the value of the symbols used.
	b. Explain and justify conclusions drawn from tables, charts, and graphs.	
	c. Understand and use appropriate vocabulary.	

02. Collect, organize, and display data.	a. Collect, organize, and display data in tables, charts, or graphs in order to answer a question and/or test a hypothesis.	i. Given the question: How much time is spent to the nearest hour doing homework (including reading), playing, and watching TV in a 24-hour period? Gather data and display information on a graph.
03. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. Given four socks: 2 blue, 2 brown, and the fact that it's dark, what is the least number of socks needed to make sure there is a matched pair.
04. Make predictions or decisions based on data.	a. Make predictions or decisions based on probable results or past experiences.	i. There are 5 crackers and 2 cookies in a sack. The cookie drawn out of the sack must be eaten. Make a decision on whether or not to draw from the bag. Explain your decision.
	b. Understand and use appropriate vocabulary.	i. Appropriate vocabulary: compare, tables, graphs, and charts.

293. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify the rule (function) that creates the pattern.	i. Identify, describe, and extend geometric and numeric patterns, including growing and shrinking patterns. • 2, 5, 8, 11, __, __, __. • __, __, __, 50, 60, 70, __, __, __.
	b. Discover, describe, and extend patterns by using manipulatives and pictorial representations.	i. Describe the pattern and explain the rule. ii. Skip counting with odd or even numbers.
	c. Understand and use appropriate vocabulary.	

294. -- 295. (RESERVED).

296. MATHEMATICS STANDARDS – GRADE 4, SECTIONS 297 THROUGH 303.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

297. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Read, write, order, and compare whole numbers to 1,000,000, commonly used fractions, and decimals through hundredths.	i. When given a set of whole numbers, order them from least to greatest. ii. Order fractions with common denominators from least to greatest. iii. Order and compare the decimal values of coins. iv. Using visual aids compare the values of commonly used fractions.
	b. Demonstrate and apply the knowledge of whole numbers, decimal place value, and patterns of periods (hundredths to millions).	i. Identify each place value up to the millions place. ii. In your classroom find a number that has a 4 in the thousands place.
	c. Determine by counting the value of a collection of bills and coins up to \$100.00.	
	d. Use concrete materials to recognize, represent, and compare commonly used fractions.	i. Given the fraction $\frac{1}{4}$, draw or show with a model, $\frac{1}{4}$ of a whole or $\frac{1}{4}$ of a group ■□□□. ii. Use pattern blocks to demonstrate $\frac{1}{3}$ (by using red trapezoid and the green triangles).
	e. Understand decimals with money through hundredths.	i. Identify and write as decimals the value of coins less than \$1.00. ii. Exchange coins of equal value (5 dimes = 50 cents). iii. Show possible ways to represent \$0.25 with coins.
	f. Understand and apply appropriate vocabulary.	
02. Perform computations accurately.	a. Consistently and accurately add and subtract whole numbers.	i. Determine the total population of Ada, Nez Perce, and Bannock counties. ii. Determine the difference between the populations of Kootenai, and Blaine Counties.
	b. Multiply and divide whole numbers.	i. Determine the population of Idaho County if it doubles. ii. Determine how many rows of desks would be needed in your classroom if each row had 5 desks.
	c. Add and subtract fractions with like denominators (without requiring simplification).	i. Add $\frac{1}{3}$ and $\frac{1}{3}$.
	d. Add and subtract decimals using money.	i. Add \$1.23 and \$2.77.

	e. Instantly recall multiplication facts through 10s.	i. Determine the total number of wheels on 9 cars. ii. If each chicken lays an egg a day, how many eggs would 6 chickens lay in 7 days? iii. Make a chart showing the multiplication facts 1 through 10.
	f. Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.	i. Decide whether a shopper has sufficient money to pay for 3 items at a grocery store. ii. Tell how you would determine the distance traveled between Lewiston and Boise (such as when the state seal moved from Lewiston to Boise).
	g. Use appropriate vocabulary.	
03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	i. Estimate the number of pizzas needed to feed a class of 30 students. ii. Round the population of the school to the nearest hundred. iii. Approximate the number of buses necessary for a school field trip.
	b. Evaluate the reasonableness of an answer.	i. Solve problems using paper/pencil or calculator and justify the answers to determine if solutions are reasonable. ii. Determine the number of cupcakes each person needs to bring for a school bake sale and explain your reasoning.
	c. Use appropriate vocabulary.	

298. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Select strategies appropriate to solve a problem.	i. Choose an appropriate strategy to count the number of floor tiles in a room.
	b. Select and use appropriate operations.	i. Given a variety of story problems, select and use the appropriate operations.
	c. Make predictions and decisions based on information.	i. Based on the number of students eating hot lunch on Monday and Tuesday, predict how many students will eat hot lunch on Wednesday.
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.	i. Choose a method and explain the possible combinations to wear when given 3 different shirts and 3 different pants. ii. Share methods with others.

03. Apply appropriate technology and models to find solutions to problems.	a. Appropriately use a 4-function calculator to solve complex grade-level problems.	i. Given a set of addition, subtraction, multiplication and division problems solve the problems accurately with a calculator.
	b. Select appropriate models to represent mathematical ideas.	i. Use a computer application to chart or graph the different colors of M&Ms found in a bag.
04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Given a map, trace the shortest route between school and the city library. Explain in writing why you chose this route. ii. Using the students' birthdays in your classroom, create a graph to show the number of birthdays each month.
	b. Use appropriate vocabulary to communicate mathematical information.	i. Convert a story problem to a number sentence using appropriate notations, terms, and labels.
	c. Use appropriate notation.	

299. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is to understand the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Select and use appropriate units and tools to make formal measurements in both systems (time, length, temperature, perimeter, area).	i. Measure the length and width of 2 faces of a cereal box using centimeters and inches.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	i. Estimate and measure the number of cups of cereal one box will yield. ii. Estimate and measure the weight of the cereal in ounces and grams. iii. Estimate and measure the number of cups in a 2-liter bottle of soda pop.
	c. Apply understanding of relationships within the U.S. customary system.	i. Measure the length of a room in yards and express the answer in feet.
	d. Apply understanding of relationships within the metric system.	i. Determine the height in centimeters of a door that is 2 meters tall.
	e. Tell time using both digital and analog clocks, to the nearest minute.	i. Write down the current time when you hand in your paper.
	f. Apply understanding of relationships to solve real-world problems related to time.	i. Determine the amount of time in hours it would take to bake 8 batches of cookies if each batch takes 15 minutes to cook. ii. Calculate the number of seconds necessary to bake 1 batch. iii. Determine your age in hours.

	g. Use appropriate vocabulary.	i. Vocabulary includes: pounds, ounces, grams, kilograms, hour, half-hour, quarter hour, minute, second, hour hand, minute hand, year, month, week, inch, foot, yard, cups, measure, meter, centimeter, liter.
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300. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Represent vertical notation in horizontal form.	i. Represent 2 $+3$ as $2 + 3 = \square$.
	b. Write a number sentence using symbols (boxes or letters) to represent an unknown number.	i. Write an equation to represent a number plus 6 is 24 ($\square + 6 = 24$). ii. There are a total of 15 boys and girls out for track this year. Write an equation using B to represent the number of boys and G to represent the number of girls out for track.
	c. Use symbols ($<$, $>$, $=$) to express relationships.	i. Use the correct symbol to make this number sentence true: $15 \square 3 + 6 + 7$.
02. Evaluate algebraic expressions.	a. Explore and use the commutative properties of addition and multiplication.	i. Balance the equation when given $5 + 5 + 5 = 3 * \square$. Note: Asterisk is a symbol for multiplication. ii. Balance the equation: $4 + \square = 10$.
03. Solve algebraic equations and inequalities.	a. Solve missing addends and missing factor problems using inverse operations.	

301. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.	i. Classify as one-, two- or three-dimensional, a line, circle, and a sphere. ii. Identify 3 dimensional figures and objects such as a cube, sphere, and a cylinder. iii. Draw a circle, triangle, rectangle, and square. Label each and explain which 2 are most alike and why.
	b. Explore relationships among and properties of shapes (congruence, similarity, symmetry).	i. Identify 2 congruent shapes. ii. Given a variety of triangles, some of which are similar, identify the similar triangles.

	c. Use concrete objects to determine perimeters of triangles, and areas and perimeters of rectangles/squares.	i. Find the perimeter and area of the top of your desk using string and tiles. ii. Arrange tiles in varied rectangular shapes (arrays) and count tiles used. iii. Given a piece of string, form 2 different rectangles with the same perimeter. iv. Using 20 crackers, form two different rectangles with different perimeters.
	d. Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.	
	e. Use appropriate vocabulary.	i. Vocabulary: line, line segment, tables, graphs, and charts.
02. Apply graphing in two dimensions.	a. Apply ideas about direction and distance.	

302. DATA ANALYSIS, PROBABILITY, AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Read and interpret tables, charts, and graphs.	
	b. Explain and justify conclusions drawn from tables, charts, and graphs.	i. Given a table of the population of various Idaho cities, determine which geographic region has the largest population. Explain the conclusion.
	c. Understand and use vocabulary.	
02. Collect, organize, and display data.	a. Collect, order, and display data in appropriate notation in tables, charts, and graphs (bar graphs, tally charts, pictographs), in order to answer a question and/or test a hypothesis.	i. Hypothesize which of 3 soda flavors are most popular in a class. Gather data and display conclusions on a graph.
03. Apply simple statistical measurements.	a. Determine an average (mean) of a set of whole numbers.	i. Find an average (mean) of 5 spelling test scores.
04. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. In a given bag of skittles, predict how many of each color will be found. ii. Count and record the number of each color.
05. Make predictions or decisions based on data.	a. Make predictions based on simple experimental probabilities.	i. Indicate how many times a coin will land on heads when flipped 20 or 25 times.
	b. Understand and use appropriate vocabulary.	

303. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify a rule (function) that creates the pattern.	i. When given a numerical pattern, extend it and identify the rule (2, 6, 18, 54, __, __, __). Rule: multiply by 3.
	b. Discover, describe, and extend patterns by using manipulatives and pictorial representations.	i. Develop a pattern and explain the rule to a partner. ii. Explain a pattern developed by a partner.
	c. Understand and use vocabulary.	

304. -- 305. (RESERVED).**306. MATHEMATICS STANDARDS – GRADE 5, SECTIONS 307 THROUGH 313.**

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

307. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Read, write, order, and compare whole numbers through billions, commonly used fractions, and decimals through thousandths.	i. Read, write, and compare large numbers. ii. Identify a digit's value in whole numbers and decimals. iii. Read, write, and compare decimal numbers. iv. Write a number with a 4 in the thousandth place and a 3 in the thousandth place.
	b. Demonstrate and apply the knowledge of whole numbers, decimal place value, and patterns of periods (thousandths to billions).	i. Use numbers, words, and pictures to explain how a tenth and a hundredth are related.
	c. Explore the relationship between equivalent fractions.	i. Use numbers, words, and pictures to explain how 0.50 and $\frac{1}{2}$ are related.
	d. Explore the relationship between decimals and simple fractions through thousandths.	
	e. Show a sense of magnitudes and relative magnitudes of whole numbers, decimals, and simple fractions.	i. Order a list of decimals ii. Order a list of simple fractions, for instance, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, or $\frac{2}{3}$, $\frac{1}{2}$, $\frac{3}{4}$.

	f. Explore and apply number theory concepts (prime, composite, multiples, factors).	i. What are the multiples of 12 and the factors of 12? ii. Use composite numbers to discover the divisibility rules for 2 and 5.
02. Perform computations accurately.	a. Multiply and divide whole numbers.	i. Use basic arithmetic facts to solve more complex problems. ii. Identify and use mathematical properties (zero property, associative, distributive, communicative, and identity property), for instance, $4 \times 12 = (4 \times 10) + (4 \times 2)$.
	b. Add and subtract fractions with like denominators and simplify as necessary.	i. Add $\frac{1}{4} + \frac{1}{4}$. ii. Subtract $\frac{3}{4} - \frac{1}{4}$.
	c. Add and subtract decimals through thousandths.	i. Add $2.34 + 51.602$.
	d. Instantly recall basic multiplication and division facts up to 10s.	i. Complete 100 division facts with single-digit factors in 3 minutes.
	e. Evaluate numerical expressions that include parentheses.	i. Solve basic expressions that have parenthesis, for instance, $4 + (2 \times 3)$.
	f. Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.	
	g. Use appropriate vocabulary.	
03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	i. Estimate all computation to determine if reasonable. ii. Round to estimate reasonable solutions ($11.436 - 6.1 = \square$).
	b. Recognize when estimation is appropriate and understand the usefulness of an estimate as distinct from an exact answer.	i. Is \$20 enough money to buy 2 CD's? Do you need an exact sum or an estimate?
	c. Determine whether a given estimate is an overestimate or underestimate.	i. Is your estimate greater or less than the actual answer? Explain.
	d. Use appropriate vocabulary.	

308. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Use a variety of strategies to compute problems drawn from real-world situations.	i. There were 31 wheels and 12 seats in a bike shop. The bike shop sold bicycles and tricycles. How many bicycles and how many tricycles were in the bike shop? ii. Plan a party for the 5 th grade. Estimate how many packages of plates you will need if plates come in packages of ten.
	b. Solve problems using the 4-step process of problem solving (explore, plan, solve, examine).	i. Identify when a problem has too much or too little information. ii. Check for reasonable answers.
	c. Make predictions and decisions based on information.	
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.	i. Explain how to use the array model of multiplication to solve this problem, for instance, 27×42 . ii. Explain how you know that 0.5 and 0.50 are equivalent.
	b. Apply solutions and strategies to new problem situations.	i. Determine how many cubes will be needed to fill a box that is 3 centimeters wide, 2-centimeters long, and 2 centimeters high.
	c. Formulate conjectures and discuss why they must be or seem to be true.	i. Formulate a conjecture about multiplying with multiples of ten and explain why it is true, for instance, $20 \times 30 = 600$.
03. Apply appropriate technology and models to find solutions to problems.	a. Understand the purpose and capabilities of appropriate technology use as a tool to solve problems.	i. Use a calculator to explore the pattern when multiplying with multiples of ten, for instance, $400 \times 20 = 8,000$.
	b. Use computer applications to display and manipulate data.	i. Use computer applications to create a bar graph representing student collected data.
	c. Select appropriate models to represent mathematical ideas.	i. Make a model to show $\frac{2}{3}$ is equal to $\frac{4}{6}$. ii. Make a model of 4×25 in different ways.
04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Use a bar graph to show favorite flavors of ice cream in the class.

	b. Use appropriate vocabulary to communicate mathematical information.	
	c. Use appropriate notation.	i. Convert a one-step story problem to a number equation using appropriate notations, terms, and labels.

309. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The step in scientific investigation is understanding the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Select and use appropriate units and tools to make formal measurements in both systems.	i. Measure the length of your desk. ii. Draw a 6-centimeter line and a 6-inch line.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	
	c. Explore the differences and relationships between perimeter and area in both systems.	i. Form 2 different rectangles, each with a perimeter of 50 centimeters. ii. Form 2 different rectangles, each with an area of 100 centimeters.
	d. Solve problems involving length, perimeter, area, weight, mass, and temperature.	i. Find the perimeter of your desk. ii. Look around the room and find an obtuse, right and acute angle.
	e. Convert unit of measurement within each system.	i. Each 5 th grader in the classroom needs 1 foot of string for an art project. How many yards of string does the class need?
	f. Apply understanding of relationships to solve real-world problems related to time.	i. If a student started reading at 10:55 a.m. and finished at 12:15 p.m., how much time has passed?
	g. Use appropriate vocabulary.	
02. Apply dimensional analysis.	a. Understand units and their relationship to one another and to real-world applications.	i. Each student reads 15 minutes a night. How many hours did each student read in a week?

310. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Explore the meaning and use of variables in simple expressions and equations.	i. What is the value of $n + 3$ if $n = 2$? ii. What is the value of n if $n + 3 = 11$?

	b. Translate simple word statements and story problems into algebraic equations.	i. Write an equation to match a story problem.
	c. Use symbols (<, >, =) to express relationships.	i. Use the correct symbol to make this number sentence true: $24 + 6 = 18 + 9$.
02. Evaluate algebraic expressions.	a. Explore and use the following properties as they relate to addition and multiplication: commutative, associative, identity, zero, and inverse.	i. Give an example or demonstrate the following properties: zero, identity, commutative, associative, distributive, and inverse.
	b. Investigate the order of operations (parentheses only).	i. Compare $(2 + 3) \times 4$ and $2 + (3 \times 4)$.
03. Solve algebraic equations and inequalities.	a. Solve missing addends and missing factor problems using inverse operations.	i. $3 \times n = 9$. ii. $5 + n = 16$. iii. Give the family of facts for (6, 4, 10) and (6, 4, 24).

311. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.	i. Find examples of these figures and objects in the real world: sphere/circle, rectangle/rectangular prism, triangle/triangular pyramid. ii. Draw a trapezoid, parallelogram, and regular polygons. iii. Explain the classification system of quadrilaterals.
	b. Explore the fundamental concepts, properties, and relationships among points, lines, rays, angles, and shapes.	i. Construct and label an acute angle, right angle, and an obtuse angle. ii. Construct and label a line, line segment, and ray.
	c. Explore congruence, similarities, and symmetry of shapes.	i. Find lines of symmetry by drawing or folding a variety of shapes. ii. Divide a square into 4 congruent parts in more than 1 way.
	d. Determine perimeters of polygons and area of rectangles/squares in real-world situations.	i. Find the perimeter of a variety of closed shapes.
	e. Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.	i. Create a design by rotating a square around a fixed point. ii. Identify shapes that will tessellate. iii. Create a design by reflecting your name.

	f. Use appropriate vocabulary.	
02. Apply graphing in two dimensions.	a. Identify and plot points on a coordinate plane.	i. Play Battleship! ii. Plot a set of points on a coordinate plane to form a picture.

312. DATA ANALYSIS, PROBABILITY AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision-making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Read and interpret tables, charts, and graphs.	i. Find a graph in the social studies textbook and interpret it.
	b. Explain and justify conclusions drawn from tables, charts, and graphs.	
	c. Understand and use vocabulary.	
02. Collect, organize, and display data.	a. Collect, organize, and display data with appropriate notation in tables, charts, and graphs.	i. Collect and display data from a class on their favorite sports.
03. Apply simple statistical measurements.	a. Find measures of central tendency - mean, median, and mode - with simple sets of data.	i. Given a set of data, identify the mean, median, and mode. ii. Line up from shortest to tallest and find the "median", or, if even number of students, find two students to "represent the median."
	b. Determine the range of a set of data.	i. Using the lengths of pencils in the classroom, determine the range.
04. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. Using 1 dice, roll the dice thirty times and record the results.
	b. Understand and use the language of probability.	i. Use outcome, probable, certain, likely, unlikely, and impossible when conducting a probability experiment.
05. Make predictions or decisions based on data.	a. Make predictions based on simple experimental probabilities.	i. Knowing the probability of a given outcome such as rolling dice, predict the likelihood of a future event.
	b. Understand and use appropriate vocabulary.	

313. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify a rule (function) that generates the pattern using whole numbers and decimals.	i. Given a numerical pattern extend it and identify the rule in as many ways as possible.
		ii. Create a numerical pattern.

	b. Discover, describe, and extend patterns by using manipulatives and pictorial representations.	i. Using toothpicks, create a geometric pattern that can be continued.
	c. Use mathematical models to show change in real context.	i. Create a graph showing how a candle's height changes over time after being lit.
	d. Understand and use appropriate vocabulary.	
02. Apply functions to a variety of problems.	a. Use patterns to represent and solve simple problems.	i. Would you rather have 15-minutes recess each day for the next 2 weeks or would you rather have 1 minute the 1 st day, 2 minutes the 2 nd day, 4 minutes the 3 rd day, and so on, through the 2 weeks. Explain your thinking using words, numbers, and pictures.

314. -- 315. (RESERVED).

316. MATHEMATICS STANDARDS – GRADE 6, SECTIONS 317 THROUGH 323.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

317. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content and Knowledge Skills:	Samples of Applications:
01. Understand and use numbers.	a. Read, write, order, and compare whole numbers, fractions, and decimals.	i. Read, write, and compare large numbers. ii. Identify a digit's value in whole numbers and decimals. iii. Read, write, and compare decimal numbers.
	b. Understand the use of fractions and decimals and their interrelationship.	i. Interpret remainders of whole number division as fractions and decimals. ii. Convert decimals to fractions and fractions to decimals.
	c. Expand the use of decimals and fractions to explore the use of percents and ratios.	i. Interpret and construct circle graphs. ii. Find the ratios of boys to girls and express it as a ratio and a fraction. iii. Identify when to appropriately use a ratio/proportion, percent, decimal or fraction; for instance, test scores use percents, metric measurement uses decimals or customary measurement uses fractions.
	d. Show a sense of magnitudes and relative magnitudes of real numbers (whole numbers, fractions, decimals).	i. Order a list of decimals and fractions. ii. Place fractions and decimals on a number line.

	e. Develop and apply number theory concepts [prime, composite, Greatest Common Factor (GCF), Lowest Common Multiple (LCM), prime factorization].	i. Use prime factors to find GCF and simplify fractions. ii. Use LCM to find common denominators. iii. Use composite numbers to discover divisibility rules.
	f. Explore the use of integers in real-world situations.	i. Identify how negative numbers occur in real life (gains/losses in football, temperature change, debt like borrowing money).
02. Perform computations accurately.	a. Consistently and accurately multiply and divide whole numbers.	
	b. Add, subtract, multiply, and divide decimals.	
	c. Add and subtract fractions with unlike denominators and simplify as necessary.	
	d. Instantly recall basic multiplication and division facts from a 12 x 12 Times Table.	i. Use basic arithmetic facts to solve more complex problems. ii. Identify and use mathematical properties (zero property, associative, distributive, communicative, and identity property).
	e. Evaluate numerical expressions using the order of operations.	i. Solve basic expressions with 2 or more operations.
	f. Explore the use of exponents.	i. Identify base number and exponent. ii. Express 5^2 as factors of 5 in standard form.
	g. Explore multiplication and division of fractions.	
	h. Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.	i. $1\frac{1}{3} + 2\frac{1}{2}$. ii. $2\frac{1}{4} - 1\frac{1}{4}$ iii. $5.28 \div 0.5$.
	i. Use appropriate vocabulary.	
03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	i. Round to estimate reasonable solutions. ii. Estimate all computation.
	b. Recognize when estimation is appropriate and understand the usefulness of an estimate as distinct from an exact answer.	i. Is \$5 enough for a Big Mac, fries and a coke? ii. Is it better to know an exact amount or estimate of money you make an hour, for instance, mowing the lawn or babysitting?

	c. Determine whether a given estimate is an overestimate or underestimate.	i. Is your estimate greater or less than the actual answer? Explain.
	d. Use appropriate vocabulary.	

318. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standards - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Use a variety of strategies to compute problems drawn from real-world situations.	i. Plan a field trip for the school; estimate how many buses will be needed. ii. The Humane Society sent a total of 21 cats and dogs to new homes.
	b. Solve problems using the 4-step process of problem solving (explore, plan, solve, examine).	i. Recognize pertinent information for problem solving. ii. Check for reasonable answers.
	c. Make predictions and decisions based on information.	
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.	i. Explain how a person would know that $\frac{1}{4}$ is equal to 0.25. ii. What happens when you multiply a fraction by a whole number, or a fraction by a fraction?
	b. Apply solutions and strategies to new problem situations.	i. Determine gas mileage, batting average, free throw percentage, etc.
	c. Formulate conjectures and discuss why they must be or seem to be true.	i. Given a set of numbers explain which are prime and which are composite numbers? And how do you know? ii. Why is the area of a triangle, $\frac{1}{2}$ the base times the height?
03. Apply appropriate technology and models to find solutions to problems.	a. Understand the purpose and capabilities of appropriate technology use as a tool to solve problems.	i. Use a calculator to explore terminating and repeating decimals.
	b. Use computer applications to display and manipulate data.	i. Use computer applications to create a circle graph representing student collected data.
	c. Select appropriate models to represent mathematical ideas.	i. Make the model to show $\frac{3}{4}$ is equal to 75% and .75. ii. Make a model of an algorithm such as $\frac{1}{4} \times \frac{1}{4}$ or $.5 \times 2$.

04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Use a line graph to show plant height change over time.
	b. Use appropriate vocabulary to communicate mathematical information.	
	c. Use appropriate notation.	i. Convert a 2-step story problem to an equation using appropriate notations.

319. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is understanding the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Select and use appropriate units and tools to make formal measurements in both systems.	i. Measure the length of your white board. ii. Create a circle with a diameter of 2 inches.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	
	c. Recognize the differences and relationships between perimeter and area in both systems.	i. What unit of measure would you use to measure a glass of water? ii. Use graph paper to find the length and area of your foot. Use cubes to find the volume of your shoe.
	d. Solve problems involving length, perimeter, area, weight, mass, and temperature.	i. Find the amount of paper you need to cover your desk. Construct an obtuse triangle.
	e. Convert unit of measurement within each system.	i. A rat had to go through a 2-meter maze. How many centimeters did he travel?
	f. Apply understanding of relationships to solve real-world problems related to time.	
	g. Use appropriate vocabulary.	
02. Apply concepts of rates and other derived or indirect measurements.	a. Explore the use of rates to make indirect measurements.	i. Traveling at a given rate, how long will it take you to travel to a given destination? (Between your city and the state capital).
03. Apply the concepts of ratios and proportions.	a. Explore the use of proportions, ratios, and scales.	i. What proportion of the class are boys? Girls? ii. Give an example of a ratio. Write the ratio in at least 3 different ways.

04. Apply dimensional analysis.	a. Understand units and their relationship to one another and to real-world applications.	i. If each student spends 75 cents on a pop everyday, how much did the class spend in a week?
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320. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Explore the meaning and use of variables in simple expressions and equations.	i. What is the value of $n + 17$ if $n = 2$?
	b. Translate simple word statements and story problems into algebraic equations.	i. Write an equation to match a story problem. ii. Translate the phrase 9 more than W is equal to sixteen.
	c. Use symbols ($<$, $>$, $=$) to express relationships.	i. Use $<$, $>$, or $=$ to make the following true: $8 \times 7 \square 60$.
02. Evaluate algebraic expressions.	a. Explore and use the following properties in evaluating mathematical and algebraic expressions: commutative, associative, identity, zero, inverse, and distributive.	i. Show how to find 28×7 using the distributive property.
	b. Explore the order of operations.	
03. Solve algebraic equations and inequalities.	a. Solve one-step equations using inverse operations with whole numbers.	i. $7 + n = 29$. ii. $3n = 363$. iii. $n /$ (or division symbol) $3 = 8$.

321. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Precisely describe, classify, and understand relationships among types of one-, two-, and three-dimensional objects using their defining properties.	
	b. Construct and measure various angles and shapes using appropriate tools.	
	c. Apply fundamental concepts, properties, and relationships among points, lines, angles, and shapes.	i. Draw and measure an acute angle. ii. Use a straight edge to draw line segment AB and label it.
	d. Recognize and apply congruence, similarities, and symmetry of shapes.	

	e. Develop and apply formulas for perimeter, circumference, and area to triangles, quadrilaterals, and circles.	i. Find the perimeter and area of a window that is 5' x 8'. ii. Use string to measure the circumference and diameter of various circles to discover the relationship.
	f. Explore the relationship between two- and three-dimensional objects.	i. What footprint would a cube or rectangular prism make? A sphere? A triangular pyramid?
	g. Explore reflections, translations, and rotations on various shapes.	i. Create a design by rotating a regular polygon around a fixed point. ii. Create a simple tessellation using pattern blocks.
	h. Use appropriate vocabulary.	
02. Apply graphing in two dimensions.	a. Identify and plot points on a coordinate plane.	i. Play Battleship! ii. Given a series of ordered pairs, connect the points to create a simple picture.

322. DATA ANALYSIS, PROBABILITY AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Read and interpret tables, charts, and graphs (line graphs, bar graphs, frequency lines or line plots, and circle graphs).	i. Given a table of times for sunrises and sunsets, identify the seasons.
	b. Explain and justify conclusions drawn from tables, charts, and graphs.	
	c. Understand and use appropriate vocabulary.	
02. Collect, organize, and display data.	a. Collect, organize, and display data with appropriate notation in tables, charts, and graphs (line graphs, bar graphs, frequency lines or line plots, and circle graphs).	i. Collect and display data from a class on their favorite radio station.
03. Apply simple statistical measurements.	a. Find measures of central tendency - mean, median, and mode - with simple sets of data.	i. Given a set of data, identify which measure of central tendency best describes the data?
	b. Determine the range of a set of data.	i. Using the heights of the students in a classroom, find the range.

04. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. Given a spinner that is $\frac{3}{4}$ red and $\frac{1}{4}$ blue predict how many times the spinner will point to red out of 100 trials?
	b. Understand and use the language of probability.	
05. Make predictions or decisions based on data.	a. Make predictions based on simple experimental probabilities.	i. Given data from an experiment with a spinner that is $\frac{3}{4}$ red and $\frac{1}{4}$ blue and 100 trials, predict the outcome of the 101 st trial.
	b. Understand and use appropriate vocabulary.	

323. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify a rule (function) that generates the pattern using whole numbers, decimals, and fractions.	i. Given a numerical pattern (whole numbers, decimals, fractions) extend it and identify the rule possibly using 1 or more than 1 operations such as "times two plus one." ii. Create a numerical pattern using 1 or more than 1 operation such as "times two plus one."
	b. Discover, describe, and extend patterns by using manipulatives and pictorial representations.	
	c. Use mathematical models to show change in real context.	i. Create a graph showing the results of a fund raising effort that brought in a small, steady amount of money in the beginning, but more each day as the deadline approached.
	d. Understand and use appropriate vocabulary.	
02. Apply functions to a variety of problems.	a. Use patterns and functions to represent and solve simple problems.	i. Would you rather have 15 cents a day or 1 cent the 1 st day, 2 cents the 2 nd day, 4 cents the 3 rd day, and so on, for two weeks? Use a model to explain your thinking.

324. -- 325. (RESERVED).

326. MATHEMATICS STANDARDS – GRADE 7, SECTIONS 327 THROUGH 333.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

327. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Read, write, order, and compare real numbers (integers, fractions, decimals) and absolute values.	i. Use decimals in computing the amount of change for making a purchase. ii. Use decimals to compute gas mileage. iii. Use fractions to determine material needed to frame a picture. iv. Use fractions to increase or decrease recipes. v. Use integers to find temperature changes.
	b. Expand the use of percents and ratios to solve problems.	i. Use percents to find savings in newspaper ads. ii. Use ratios to find unit rates at the grocery store. iii. Use ratio to construct models or drawings.
	c. Show a sense of magnitudes and relative magnitudes of real numbers (integers, fractions, decimals).	i. Order a list of decimals and fractions.
	d. Develop and apply number theory concepts.	i. Identify prime factors. ii. Use greatest common factor and least common multiple in solving fraction problems.
	e. Understand the position of rational numbers on a number line.	i. Locate a given set of rational numbers on a number line. ii. Accurately identify positive and negative integers on a thermometer.
02. Perform computations accurately.	a. Add, subtract, multiply, and divide fractions and decimals.	i. Create a monthly balance sheet given earnings and expenses. ii. Find the total food supplies for a complete day's menu.
	b. Evaluate numerical expressions using the order of operations.	i. Solve basic expressions with 2 or more operations. ii. Find the area of a trapezoid.
	c. Explore the use of exponents.	i. Express 5^3 as factors of 5 and in standard form.
	d. Explore basic operations with integers.	i. -4 subtract -3 using a number line and negative/positive chips.
	e. Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.	
	f. Use appropriate vocabulary.	

03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	i. Estimate the cost of school supplies for the year. ii. Estimate the amount of flour and sugar needed when a recipe is increased.
	b. Recognize when estimation is appropriate and understand the usefulness of an estimate as distinct from an exact answer.	i. Compare and explain the difference between the actual cost the school supplies and the estimated cost. ii. List examples of when it is useful to estimate. iii. List examples of when an estimate is not useful.
	c. Determine whether a given estimate is an overestimate or underestimate.	i. Estimate the cost of items from newspaper ads, giving 1 that is over and 1 that is under for each item.
	d. Use appropriate vocabulary.	

328. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Use a variety of strategies including common mathematical formulas to compute problems drawn from real-world situations.	i. Find the square yards needed to carpet rooms in a house. ii. Plan a breakfast for the class and figure total amount of supplies and the cost. iii. Determine the sales tax on the purchase of a new car.
	b. Recognize pertinent information for problem solving.	i. Given a problem, identify the essential information and eliminate the nonessential information.
	c. Make predictions and decisions based on information.	
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.	
	b. Apply solutions and strategies to new problem situations.	i. Apply knowledge of finding the area of a rectangle to finding the area of a parallelogram.
	c. Formulate conjectures and discuss why they must be or seem to be true.	i. Discuss the statement that all locations along the equator always have very high temperatures. ii. Discuss the statement that all locations along the 20 th parallel have extended daylight hours during the summer.

03. Apply appropriate technology and models to find solutions to problems.	a. Understand the purpose and capabilities of appropriate technology use as a tool to solve problems.	i. Use a calculator to find the mean of a set of experimental data.
	b. Use computer applications to display and manipulate data.	i. Use computer applications to create graphs and tables for a set of experimental data.
	c. Select appropriate models to represent mathematical ideas.	
04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Create a tree diagram or table to show all possible outcomes of 2 consecutive coin tosses. ii. Create a chart or write an explanation for the pattern used to solve a problem. iii. Create a graph to explain the population differences among 5 major Idaho counties.
	b. Use appropriate vocabulary to communicate mathematical information.	
	c. Use appropriate notation.	

329. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is understanding the measurable attributes of objects.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Select and use appropriate units and tools to make formal measurements in both systems.	i. Select and use the appropriate tool to measure the length of a hallway. ii. Accurately measure a variety of angles.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	
	c. Recognize the differences and relationships among measures of perimeter, area, and volume (capacity) in both systems.	i. Model length, area, and volume using various manipulatives (strings, tiles, and cubes).
	d. Solve problems involving length, perimeter, area, volume (capacity), weight, mass, and temperature.	i. Design and construct a rectangular prism using grid paper. Determine the perimeter and area of each face and the volume for prism. ii. Find the amount of fencing material needed to fence a playground.
	e. Convert unit of measurement within each system.	
	f. Use appropriate vocabulary.	

02. Apply concepts of rates and other derived or indirect measurements.	a. Develop the use of rates to make indirect measurements.	i. Compare the rate of travel for 2 different vehicles using distance equals rate times time. ii. Given the weight of 1 gallon of water, calculate the weight of water in the classroom fish tank.
03. Apply the concepts of ratios and proportions.	a. Develop the use of proportions, ratios, and scales.	i. Use map scale to determine distances. ii. Enlarge a cartoon to a given scale.
04. Apply dimensional analysis.	a. Understand units and their relationship to one another and to real-world applications.	i. If each student spends 75 cents on a pop everyday, how much did the class spend in a week?

330. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Develop the use of variables in simple expressions and equations.	i. Read expressions like " $n + 34$ " and explain what happens when the value of " n " is changed.
	b. Translate simple word statements and story problems into algebraic expressions and equations.	i. Translate phrases like "a number less 5" into an algebraic expression where "a number" is replaced with a letter variable (using a variety of terms for instance, increase, decrease, product, sum, quotient, difference). ii. Given the hourly wage, write an algebraic expression to represent the total wages for 8 hours of work.
	c. Use symbols ($<$, $>$, $=$, \leq , \geq , \neq) to express relationships.	
02. Evaluate algebraic expressions.	a. Develop an understanding of using the following properties in evaluating mathematical and algebraic expressions: commutative, associative, identity, zero, inverse, and substitution.	i. Use the commutative property to rewrite $15 + 8 + 5 = 28$. ii. Use the substitution property to evaluate $x + 15$, if $x = 8$.
	b. Understand and use the order of operations in evaluating basic algebraic expressions.	i. Explain why the order of operation is important when evaluating expressions such as $3 + 2 * 8$.
03. Solve algebraic equations and inequalities.	a. Solve one-step equations using inverse operations.	i. Solve one-step equations such as $23 + x = 65$, and show how to solve it using the inverse operation.
	b. Explore solutions of simple one-step equations using negative numbers.	i. $-5 + x = 3$.

	c. Explore graphical representation to show simple linear equations.	i. Create a graphical representation of a linear equation. ii. Use technology to create a graph of a linear relation.
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331. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Precisely describe, classify, and understand relationships among types of one-, two-, and three-dimensional objects using their defining properties.	
	b. Construct and measure various angles and shapes using appropriate tools.	
	c. Apply fundamental concepts, properties, and relationships among points, lines, planes, angles, and shapes.	i. Build symmetrical patterns with pattern blocks. ii. Construct various congruent polygons.
	d. Recognize and apply congruence, similarities, and symmetry of shapes.	
	e. Apply formulas for perimeter, circumference, and area to triangles, quadrilaterals, and circles.	i. Calculate the area of the basketball court. ii. Calculate the perimeter of a fish tank.
	f. Explore the concept of surface area and volume (capacity).	i. Construct a rectangular prism on grid paper, and find its surface area. ii. Use cubes to find the volume of a box.
	g. Explore and model the effects of reflections, translations, and rotations on various shapes.	i. Construct a pentomino puzzle. ii. Create a tessellation.
	h. Use appropriate vocabulary.	
02. Apply the geometry of right triangles.	a. Explore right triangle geometry.	i. Construct a 3-4-5 right triangle using grid paper. Construct other Pythagorean triples and discuss similarities.
03. Apply graphing in two dimensions.	a. Identify and plot points on a coordinate plane.	i. Create a simple dot-to-dot picture by locating points on a coordinate plane, given a series of ordered pairs.

332. DATA ANALYSIS, PROBABILITY AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision-making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Read and interpret tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).	i. Discuss and compare a selection of graphs collected from the newspaper. ii. Given a bar or line graph, explain where there are increases and decreases.
	b. Explain and justify conclusions drawn from tables, charts, and graphs.	
	c. Understand and use appropriate vocabulary.	
02. Collect, organize, and display data.	a. Collect, organize, and display data with appropriate notation in tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).	i. Collect and display data on experiments finding the number of drops of water that will stay on a head of a penny. ii. Collect and display data on the number of books read over the summer months for all the 7 th graders. iii. Extend a class collection of data to include the school population.
03. Apply simple statistical measurements.	a. Understand and use the measures of central tendency - mean, median, and mode - with simple sets of data.	i. Compute individual grade average for math class. ii. Find the median number of pets belonging to students in a class. iii. Find the most common birthday month in a 7 th grade class and all 7 th grade classes.
	b. Explore the significance of range, frequency, and informal distribution.	i. Create a frequency table for favorite kinds of pizza of class members. ii. Find the range of a set of grades on a given test and discuss clusters and gaps.
04. Understand basic concepts of probability.	a. Predict, perform, and record results of simple probability experiments.	i. Find the probability of getting all 5 colors of pens out of cereal boxes by rolling die.
	b. Understand and use the language of probability.	
	c. Recognize equally likely outcomes.	i. Document frequency of spins on a spinner with 3 equal sections.
05. Make predictions or decisions based on data.	a. Make predictions based on simple experimental and theoretical probabilities.	i. Find the theoretical and experimental probability of tossing a coin and getting heads 4 times in a row.
	b. Understand and use appropriate vocabulary.	

333. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify a rule (function) that generates the pattern using real numbers.	i. Extend a triangular pattern sequence and explain the rule mathematically. ii. Explain how the amount of sales tax depends on the cost of the item.
	b. Use functional relationships to explain how a change in one quantity results in a change in another.	i. Find the number of book covers needed for a classroom if each student must cover 5 books. Explain how the number of covers will change as the number of students' change.
	c. Understand and use appropriate vocabulary.	
02. Represent equations, inequalities, and functions in a variety of formats.	a. Represent a simple set of data in a table, as a graph, and as a mathematical relationship.	i. Collect data for 2 to 3 weeks on the daily the temperature for a city in Idaho and organize and display the results in several forms, including tables and graphs.
03. Apply functions to a variety of problems.	a. Use patterns and functions to represent and solve problems.	i. Construct a table to show the pattern and find out how many handshakes would take place at a party of 16 people if everyone shook hands with every other person once.

334. -- 335. (RESERVED).**336. MATHEMATICS STANDARDS – GRADE 8, SECTIONS 337 THROUGH 343.**

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

337. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Read, write, order, and compare real numbers (integers, fractions, decimals, percents, ratios) and absolute values.	i. Interchange fractions, decimals, or percents, to determine pricing markup or markdown. ii. Use fractions to increase or decrease recipes. iii. Use percentages to computer taxes and commissions. iv. Use decimals to computer interest problems. v. Use ratios to compute sports averages (batting averages). vi. Which has greater absolute value, -5 or 2?

	b. Understand and use real numbers, both rational and irrational.	i. Explain that irrational numbers neither terminate nor repeat when written in decimal form. ii. Calculate the square root of a number to the thousandths.
	c. Show a sense of magnitudes and relative magnitudes of real numbers (integers, fractions, decimals) using scientific notation and exponential numbers.	i. Express distances in our solar system using scientific notation. ii. Order a list of fractions, decimals, and exponential numbers.
	d. Develop and apply number theory concepts.	i. Identify prime factorization, greatest common factors and least common multiples.
	e. Understand the position of real numbers on a number line.	i. Locate a given set of real numbers on a number line. ii. Accurately identify positive and negative integers on a thermometer.
02. Perform computations accurately.	a. Consistently and accurately add, subtract, multiply, and divide rational numbers.	i. Plan a road trip. Record and calculate gas mileage, food and lodging expenses.
	b. Instantly recall common equivalent fractions, decimals, and percents.	
	c. Evaluate numerical expressions using the order of operations.	i. Find the surface area of a cylinder.
	d. Understand and use exponents.	i. Solve problems using exponential growth, for instance, Sally tells 3 friends a secret. The next day those 3 friends tell 3 other friends. If this pattern continues for 5 days, how many friends will hear the secret?
	e. Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.	
	f. Use appropriate vocabulary.	
03. Estimate and judge reasonableness of results.	a. Use estimation to predict computation results.	
	b. Recognize when estimation is appropriate and understand the usefulness of an estimate as distinct from an exact answer.	i. Estimate the population of people at the mall on any given date. ii. Explain why or when exact answers might be necessary.

	c. Determine whether a given estimate is an overestimate or underestimate.	i. Estimate driving time to a given destination and compare to actual time (given particular miles per hour).
	d. Use appropriate vocabulary.	

338. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Use a variety of strategies, including common mathematical formulas to compute problems drawn from real-world situations.	i. Determine amount of interest earned in a savings account. ii. Compute amount of paint needed for a bedroom. iii. Given \$500 to plan a year-end class party using several committees, develop a budget for the party.
	b. Recognize pertinent information for problem solving.	i. Given a problem, identify essential information.
	c. Make predictions and decisions based on information.	
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use a variety of methods, such as words, numbers, symbols charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.	
	b. Apply solutions and strategies to new problem situations.	i. After finding the area of square, find the surface area of a cube.
	c. Formulate conjectures and justify (short of formal proof) why they must be or seem to be true.	i. Debate the following: If people like cheese and mice like cheese, then people are mice. ii. On a crisp autumn day, the 1 st four students to class are wearing shorts. What will be the possible attire of the rest of the students in the class? Explain.
03. Apply appropriate technology and models to find solutions to problems.	a. Understand the purpose and capabilities of appropriate technology use as a tool to solve problems.	i. Use technology to find the square root of 5,281.
	b. Use computer applications to display and manipulate data.	i. Display and compare the frequency of various M&M colors using computer applications.
	c. Select appropriate models to represent mathematical ideas.	

04. Communicate results using appropriate terminology and methods.	a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.	i. Write an explanation on how to solve a problem. ii. Display results of a problem in graphic form.
	b. Use appropriate vocabulary to communicate mathematical information.	
	c. Use appropriate notation.	

339. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is understanding the measurable attributes of objects.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Select and use appropriate units and tools to make formal measurements using both systems.	i. Select and use the appropriate tool to measure the length of a school building, the length of a classroom, the length of a thumbtack and the length of a student's shoe. ii. Measure the interior angles of a triangle.
	b. Apply estimation of measurement to real-world and content problems using actual measuring devices.	
	c. Recognize the differences and relationships among measures of perimeter, area, and volume (capacity) in both systems.	i. Model length, area, and volume using various manipulatives (string, tiles, and cubes).
	d. Solve problems involving length, perimeter, area, volume (capacity), weight, mass, and temperature.	i. Design and determine how much lumber would be needed for an average size doghouse. ii. Design a laser alarm system using numerous mirrors as reflection points.
	e. Convert unit of measurement within each system.	
	f. Use appropriate vocabulary.	
02. Apply concepts of rates and other derived or indirect measurements.	a. Use rates to make indirect measurements.	i. Use formulas and appropriate procedures for solving measurement problems, for instance, distance equals rate * time. ii. Given the weight of 1 gallon of water, calculate the weight of water in the swimming pool.
03. Apply the concepts of ratios and proportions.	a. Understand and use proportions, ratios, and scales.	i. Use proportions to find the height of a flagpole. ii. Use map scale to determine distances. iii. Enlarge a cartoon to a given scale.

04. Apply dimensional analysis.	a. Understand units and their relationship to one another and to real-world applications.	i. Determine the reading hours of an entire class if everyone reads 20 minutes.
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340. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical relationships.	a. Understand and use variables in expressions, equations, and inequalities.	i. If B represents the number of boys in the class, and G represents the number of girls in the class, write an equation and solve it in the number of students in the classroom.
	b. Translate simple word statements and story problems into algebraic expressions and equations.	i. Given that the price of gas is changing each week, write an algebraic expression to represent the cost of purchasing 10 gallons of gas.
	c. Use symbols ($<$, $>$, $=$, \leq , \geq , \neq) to express relationships.	
02. Evaluate algebraic expressions.	a. Understand and use the following properties in evaluating algebraic expressions: commutative, associative, identity, zero, inverse, distributive, and substitution.	i. Evaluate expressions such as $2x + y$ when given values for x and y .
	b. Understand and use the order of operations in evaluating basic algebraic expressions.	i. Explain why order of operations is important when evaluating expression such as: $3 + 2 * 8$.
	c. Simplify algebraic expressions.	i. Simplify expressions such as: $3a + 4b - 5a + 6b - 7$.
03. Solve algebraic equations and inequalities.	a. Solve one- and two-step equations and inequalities using inverse operations.	i. Solve equation such as: $12x - 5 = 31$.
	b. Explore graphical representation to show simple linear equations.	i. Use technology to create a graph of linear relations.

341. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Precisely describe, classify, and understand, relationships among types of one-, two-, and three-dimensional objects using their defining properties.	

	b.	Construct and measure various angles and shapes using appropriate tools.	
	c.	Understand and apply fundamental concepts, properties, and relationships among points, lines, planes, angles, and shapes.	i. Compare measurements of opposite and alternate angles in a parallelogram.
	d.	Recognize and apply congruence, similarities, and symmetry of shapes.	
	e.	Apply formulas for perimeter, circumference, and area to polygons and circles.	i. Calculate the area of a center circle of a basketball court.
	f.	Understand the concept of surface area and volume (capacity).	i. Construct a cylinder and calculate its surface area and volume (capacity).
	g.	Explore and model the effects of reflections, translations, and rotations on various shapes.	i. Create a tessellation using a combination of reflection, translation or rotation showing movement on a plane.
	h.	Use appropriate vocabulary.	
02. Apply the geometry of right triangles.	a.	Investigate right triangle geometry using the Pythagorean Theorem.	i. Investigate the relationships among the 3 sides of a right triangle of a Pythagorean triple. ii. Determine the length of a handicap access ramp given the height and length of the incline.
03. Apply graphing in two dimensions.	a.	Use the coordinate plane as it relates to real-world applications.	

342. DATA ANALYSIS, PROBABILITY AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision-making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Analyze and interpret tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).	i. Analyze and interpret bar graphs and pie charts in magazines or newspapers. ii. Given a scatter plot, choose a line of best fit.
	b. Explain and justify conclusions drawn from tables, charts, and graphs.	
	c. Understand and use appropriate vocabulary.	

02. Collect, organize, and display data.	a. Collect, organize, and display data with appropriate notation in tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).	i. Collect and display data by surveying the actual number of chocolate chips in cookies. ii. Survey and graphically display music preference categories. iii. Identify the usefulness and/or limitations of surveys.
03. Apply simple statistical measurements.	a. Choose and calculate the appropriate measure of central tendency – mean, median, and mode.	i. Compute an individual mean grade in a particular course. ii. Find the median student height in a classroom. iii. Find the most common shoe size in your class.
	b. Explore the significance of range, frequency, and informal distribution.	i. Calculate range and distribution of professional basketball salaries. ii. Create a frequency distribution chart of professional basketball salaries.
04. Understand basic concepts of probability.	a. Model situations of probability using simulations.	i. Find the probability of drawing a jack of hearts in a standard deck of cards. ii. Use a spinner to represent the number of points scored by a 75% free throw shooter in a basketball game.
	b. Understand and use the language of probability.	
	c. Recognize equally likely outcomes.	i. Document frequency of heads and tails when flipping a coin 100 times.
05. Make predictions or decisions based on data.	a. Make predictions based on experimental and theoretical probabilities.	i. Find the theoretical and experimental probability of throwing a pair of 6 sided number cubes and getting a sum of 7.
	b. Understand and use appropriate vocabulary.	
	c. Conduct statistical experiments and interpret results using tables, charts, or graphs.	i. Graphically display the results of 40 spins of a 4-quadrant spinner; explain the results.

343. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard – The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Extend patterns and identify a rule (function) that generates the pattern using real numbers.	i. Extend the 1 st five numbers in the Fibonacci sequence and explain the rule. ii. Explain how the amount of sales tax depends on the cost of the item.

	b. Use functional relationships to explain how a change in one quantity results in a change in another.	i. Find the number of pencils needed for a classroom if each student must have 3 pencils. Explain how the number of pencils needed will change as the number of students' change. ii. Using what we know about a 3, 4, 5, right triangle, prove a corner of a room is square or not square.
	c. Understand and use appropriate vocabulary.	
02. Represent equations, inequalities, and functions in a variety of formats.	a. Represent a set of data in a table, as a graph, and as a mathematical relationship.	i. Collect data on the temperature of hot water as it cools over time and organize and display the results in several forms, including tables and graphs.
03. Apply functions to a variety of problems.	a. Use patterns and functions to represent and solve problems.	i. Illustrate on a line graph distance traveled at a constant speed of 55 miles per hour.

344. -- 345. (RESERVED).

346. MATHEMATICS STANDARDS – GRADES 9 THROUGH 12, SECTIONS 347 THROUGH 353.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

347. BASIC ARITHMETIC, ESTIMATION, AND ACCURATE COMPUTATIONS.

Rationale: An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use numbers.	a. Understand and use positive and negative numbers, fractions, decimals, percentages, and scientific notation.	i. Use positive and negative numbers (credits and debits) in accounting. ii. Use fractions when mixing solutions, in measuring with a ruler, or in recipes. iii. Use decimals in computing gas mileage or in measuring with a micrometer. iv. Use percentages when computing sales tax, tips, or commissions. v. Use scientific notation when working with very large or small numbers, such as distance in outer space or microscopic scales.
	b. Understand properties of the real number system.	i. Analyze real number relationships based on the position of numbers on a number line (e.g., using relative magnitude, absolute value). ii. Explain why the set of even numbers is closed under addition and the set of odd numbers is not.
	c. Understand properties of roots, exponents, and logarithms.	i. Plot exponential growth using log scale graph paper.

	d. Use number theory concepts (divisibility rules, factors, multiples, primes) to solve problems.	i. Find the largest size square tile that you could use to tile two rooms of different dimensions using only whole tile.
02. Perform computations accurately.	a. Use the proper order of operations. Perform operations with real numbers.	i. Use mental math to determine correct change. Balance a checkbook. ii. Find the average of a set of data.
	b. Use graphs, matrices, and sequences to represent and solve problems.	i. Compute compound interest from the number of compounding periods, principal, and annual interest rate. ii. Use a matrix to adjust a recipe for six to serve crowds of 20, 30, and 40.
03. Estimate and judge reasonableness of results.	a. Apply number sense to every day situations.	i. Estimate how much lumber you need to build a deck. ii. Estimate how much you can afford to borrow on a loan given the interest rate. iii. Estimate driving time to a given destination.

348. MATHEMATICAL REASONING AND PROBLEM SOLVING.

Rationale: These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use a variety of problem-solving skills.	a. Use a variety of methods, including common mathematical formulas, to solve problems drawn from daily life.	i. Determine the payment required on a loan. ii. Compute the amount of wallpaper, paint, or curtains needed in your kitchen, bath or bedroom. iii. Determine the amount of paint needed to paint a house.
02. Use reasoning skills to recognize problems and express them mathematically.	a. Use inductive and deductive reasoning to set up a problem.	i. Write a paragraph explaining a solution to a problem.
	b. Use logic to make mathematical proofs.	i. Prove a corner is square using the Pythagorean Theorem.
	c. Make and evaluate logical arguments.	i. Explain why it is not possible to divide by zero.
03. Apply appropriate technology and models to find solutions to problems.	a. Understand the purpose and capabilities of appropriate technology.	i. Use graphing calculators to fit curves to data. ii. Use computers for manufacturing process control.
	b. Understand the nature and use of mathematical models.	i. Set up a spreadsheet to model financial or statistical problems. ii.
04. Communicate results using appropriate terminology and methods.	a. Select the appropriate means to communicate mathematical information.	i. Create charts or graphs to represent demographic data. ii. Plot the graph of a function based on experimental data. iii. Use a control chart to determine

		whether a change is needed in a manufacturing process. iv. Determine whether a table, pie chart, or bar graph best communicates a set of data.
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349. CONCEPTS AND PRINCIPLES OF MEASUREMENT.

Rationale: The first step in scientific investigation is to understand the measurable attributes of objects.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand and use U.S. customary and metric measurements.	a. Determine length, area, capacity, weight, time, and temperature, with appropriate units.	i. Measure the length of a board to the nearest sixteenth of an inch. ii. Determine the volume of an aquarium in liters.
02. Apply concepts of rates and other derived or indirect measurements.	a. Understand equivalent units, comparable units, and conversions.	i. Compute speed such as kilometers per hour. ii. Compute gas consumption in miles per gallon. iii. Calculate snow load on a roof in pounds per square foot. iv. Compute the percentage of body fat.
03. Apply the concepts of ratios and proportions.	a. Understand and use proportions, ratios, and scaling.	i. Build and use scale models. ii. Determine distance from map scale. iii. Determine the mechanical advantage of levers or gears. iv. Calculate size limitations based on strength of materials. v. Calculate amounts of concentrated ingredients needed for a specified mixture.
04. Apply dimensional analysis.	a. Understand units and their relationship to one another and to real world applications.	i. Check reasonableness of a calculation based on the resulting units. ii. Convert miles per hour to seconds per mile.
05. Perform error analysis.	a. Understand tolerance, precision, and their applications.	i. Explain how the error in computing the area of a rectangle depends on the errors in measuring its length and width. ii. Calculate error introduced by uncalibrated laboratory equipment.
	b. Understand that error accumulates in a computation when there is rounding at intermediate steps.	i. Determine the amount of money lost by a restaurant if portions are too large.

350. CONCEPTS AND LANGUAGE OF ALGEBRA.

Rationale: Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Use algebraic symbolism as a tool to represent mathematical	a. Understand and use variables, expressions, equations and inequalities.	i. Represent FICA as a percentage of gross salary. ii. Model voltage, current, and resistance in electrical circuits.

relationships.		iii. Express the formula for determining the amount of concentrate needed to make a diluted solution.
02. Evaluate algebraic expressions.	a. Understand and use procedures for operating on algebraic expressions.	i. Calculate gas mileage from distance traveled and gallons used. ii. Determine sales tax plus tip to compute the final bill in a restaurant. iii. Determine the monthly payment on a loan given the amount borrowed, term, and interest rate. iv. Find the value of an annuity given the payment, interest rate, and number of years.
03. Solve algebraic equations and inequalities.	a. Understand and use appropriate procedures to solve linear equations and inequalities such as $3x - 4 = 2$ or $3x - 4 > 2$.	i. Convert temperatures between Fahrenheit and Celsius. ii. Determine the rate per kilowatt-hour in a utility bill given the amount charged and kWh used for two data points. iii. Solve time-rate-distance problems.
	b. Use appropriate procedures to simplify and solve polynomial equations and inequalities such as $x^2 + 3x = 7$ or $x^2 + 3x \leq 7$.	i. Solve braking and acceleration problems for automobiles. ii. Find trajectories for falling objects such as baseballs or arrows. iii. Determine how area scales in relation to side length.
04. Solve simple linear systems of equations or inequalities.	a. Understand and use appropriate procedures to solve simple linear systems of equations and inequalities such as $x + y = 7$ $2x + 3y = 21$ or $x + y < 7$ $2x + 3y \geq 21$.	i. Do break-even analysis given linear supply and demand. Solve mixture problems. ii. Use linear programming to find feasible regions for manufacturing processes.

351. CONCEPTS AND PRINCIPLES OF GEOMETRY.

Rationale: The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Apply concepts of size, shape, and spatial relationships.	a. Understand congruence and similarity as they apply to reflection, rotation, and translation.	i. Determine the amount of carpet needed for an irregularly shaped room. ii. Determine the amount of concrete needed for a foundation or driveway. iii. Determine how to lay out the pieces when making a quilt.
	b. Understand scaling as it relates to size variations in one, two, and three-dimensional objects, while shape is maintained.	i. Create scale models of buildings. ii. Create a drawing to scale of a geometric figure.

02. Apply the geometry of right triangles.	a. Understand the basic concepts of right triangle trigonometry (basic trigonometry ratios such as sine, cosine, and tangent).	i. Find the center of a circle using inscribed right triangles. ii. Define the tangent, sine, and cosine ratios for an acute angle in a right triangle.
	b. Use trigonometric ratio methods to solve problems.	i. Determine the pitch of a roof from its width and the length of the rafters. ii. Measure the height of a tree from the length of its shadow using elementary trigonometry.
	c. Know and apply the Pythagorean Theorem to solve real world problems.	i. Determine whether a corner is square using the "3-4-5" right triangle.
03. Apply graphing in two dimensions.	a. Understand concepts of the Cartesian Coordinate System.	i. Graph linear equations and inequalities. ii. Rotate solutions to inequalities using a graphing calculator. iii. Represent experimental data with graphs. iv. Use computer assisted drafting and design.
	b. Understand the characteristics and uses of vectors.	i. Determine the relative velocity of boat moving upstream in a river. ii. Determine the force necessary to prevent a barrel from rolling down an incline.

352. DATA ANALYSIS, PROBABILITY, AND STATISTICS.

Rationale: With society's expanding use of data for prediction and decision-making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand data analysis.	a. Read and interpret tables, charts, and graphs (scatter plots, line graphs, three-dimensional graphs, and pie charts).	i. Analyze and interpret bar graphs and pie charts in magazines or newspapers. ii. Use topographical maps. iii. Choose the line of best fit from a scatter plot of heights and weights.
02. Collect, organize, and display data.	a. Collect and organize data, and display the data in tables, charts, and graphs (scatter diagrams, frequency tables, bar graphs, or pie charts).	i. Conduct a survey of product preferences. ii. Collect data for surveying land. iii. Represent demographic data graphically. iv. Collect and display data for a financial audit.
03. Apply simple statistical measurements.	a. Understand basic statistical concepts including mean (average), median, mode, range, and standard deviation.	i. Compute average grade in a class. ii. Explain the differences between the mean and median prices of new homes. iii. Understand how standard deviation applies to quality control.

04. Understand basic concepts of probability.	a. Understand experimental and theoretical probability.	i. Analyze card games, dice games, and lotteries as chance events.
	b. Distinguish between independent and dependent events.	i. Determine the probability of having an accident using past accident data.
	c. Know that probability ranges from 0% to 100%. Understand randomness and chance.	i. Explain what the meteorologist means by "35% chance of rain tomorrow."
05. Make predictions or decisions based on data.	a. Use appropriate technology to employ simulation techniques, curve fitting, correlation, and graphical models to make predictions or decisions based on data.	i. Predict population trends using mathematical models. ii. Predict economic trends from economic models.
	b. Design, conduct, and interpret results of statistical experiments.	i. Predict a team's final win/loss record at midseason. ii. Use data from a manufacturing process to determine whether the process is out of control.
	c. Analyze the effect of biased data on statistical predictions.	i. Select a non-random sample from a student population and examine inherent bias.

353. FUNCTIONS AND MATHEMATICAL MODELS.

Rationale: One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
01. Understand the concept of functions.	a. Solve problems that involve varying quantities with variables, expressions, equations, inequalities, and absolute values.	i. Explain how a power bill depends on the amount of electricity used. ii. Explain how the amount of the sales tax depends on the cost of an item. iii. Identify domain and range in an income tax table.
02. Represent equations, inequalities and functions in a variety of formats.	a. Represent a set of data in a table, a graph, and as a mathematical relationship.	i. Use function formulas with paper and pencil, program function formulas into graphing calculators, or input function formulas into spreadsheets. ii. Display function graphs on graph paper, graphing calculators, or computer displays. iii. Display experimental data in a table.
03. Apply functions to a variety of problems.	a. Model real-world phenomena using polynomial, rational, and basic exponential functions, noting restricted domains.	i. Represent revenue as a function of items sold. ii. Model crop yield as a function of fertilizer used. iii. Illustrate velocity as a function of time. iv. Model gross income as a function of years of education. v. Investigate the growth of a population versus the birthrate.